Human Accelerator

Background:
Scientist at Jefferson Lab study atoms using a machine called an electron accelerator. Jefferson Lab's accelerator produces a beam of fast moving electrons by passing them through hollow metal devices called cavities. An alternating sequence of electrical charges is created on the Materials for Human Accelerator surface of the cavities and these charges accelerate the electrons. The cavities are arranged in two long, straight sections called Linear Accelerators. In this activity, students pass tennis balls down a line like Jefferson Lab's cavities 'pass' electrons down the Linear Accelerators.

Minimum Materials Needed for Each Student Group:
~20 tennis balls
2 containers to hold the tennis balls

1. Stand side by side, shoulder to shoulder with your class. Your class is now a linear accelerator that will help deliver the electron beam to its target.
2. The first person in the line will act as the injector. Every other person in the line is a cavity. The last person in line will hit the target with the electrons.
3. Cup your hand that is closest to the injector in the upward direction and the other hand downward.
4. As the electrons that make up the beam are injected you will transfer them along the accelerator by bringing your hands together and then moving them back to their original position as a leader calls "in...out...in...out..." in constant rhythm. When your hands come together, or in, you will transfer the electrons from one hand to the other. When your hands go out you will transfer them to the next cavity in line.
5. You must continue to do your job **even if you don't have any electrons** so that the accelerator may continue operating.
6. Do not pick up any lost electrons.
7. After the beam has been delivered to its target, use the **Human Accelerator Data**

Chart on the next page to record your data.

1. How easy is it to work together as a team?

Human Accelerator Data Chart

Beam Type	Number of balls **Injected**	Number of balls **Delivered**	Fraction Delivered	Percent Delivered
Pulsed Beam				
Continuous Beam (slow cadence)				
Continuous Beam (fast cadence)				
Eyes Shut				
Other				

ANALYSIS

1)

Teacher Materials

Human Accelerator
This is an activity in which students simulate Jefferson Lab's accelerator by passing tennis balls down a straight line.

Objectives:
In this activity students will:

- cooperate with their partners to complete a task
- pass tennis balls down a line of students to simulate a linear accelerator
- record the number of tennis balls that successfully made it to the end of the line
- calculate the fraction of tennis balls that successfully made it to the end of the line
- use division and multiplication to convert each fraction into a percent
- create a pie graph for each fraction

Questions to Ask:
1. Which method of passing the tennis balls was the most difficult?
2. What are some ways your team worked well together?
3. Where are some places you use percents?